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ABSTRACT

This journal contains brief descriptions of calculator-active materials that were found using Resource Finder, the searchable online catalog of curriculum resources from the Eisenhower National Clearinghouse (ENC). It features both the calculators themselves and the activity books that are used with them. Among the calculators included are those that display fractions in improper, mixed, and reduced forms; graph functions in several colors; or perform symbolic algebraic, differential, and integral manipulations. Also highlighted are calculators that allow students to explore interactive geometry and to incorporate real-world data through connection with a data collection system. Some of the activity books described integrate the use of manipulatives with calculators and employ the calculator as a teaching tool rather than simply a method of checking answers and computing with large numbers. These activity books offer a variety of activities ranging from those that teach number sense to activities that foster explorations of patterns and relationships in functions. Sections include: (1) Calculators for Grades K-8; (2) Calculators for Grades 9-12; (3) Teaching Materials; and (4) Professional Development Materials. (JRH)

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Volume 4, Issue 2, 1997

ED 408 156

enc FOCUS

For Mathematics and Science Education

Calculator-Active Materials

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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Using ENC to learn more about calculators

The Eisenhower National Clearinghouse for Mathematics and Science Education was established to help K–12 teachers locate useful teaching materials. The Clearinghouse collects all types of materials at the National Repository in Columbus, Ohio, at The Ohio State University. ENC makes information available about all of these resources in several ways. For example, this print catalog is one of a series that highlights specific topics and resources in math and science. All of ENC's resources in combination will provide comprehensive information for teachers on a variety of topics, including calculators.

ENC Online

ENC Online has links to exemplary science and math Internet sites through the Digital Dozen, selected monthly, classroom links, and other educational resources. Some Internet sites are available with information about using calculators. You can find them in two ways: search Resource Finder, or browse through the links on ENC Online. If you have time to browse, you will find all kinds of things you might be able to use in your classroom. ENC Online also links to some of the full-text articles featured on ENC CDs.

ENC CDs

ENC's CD-ROMs have a variety of previously published documents in electronic format about curriculum issues in math and science education including curriculum support materials, state curriculum frameworks, and articles from professional journals. These documents cover curriculum standards and implementation, and include the complete 1989 *NCTM Curriculum and Evaluation Standards for School Mathematics*. These documents and other valuable materials are included on ENC's CD-ROMs, which are available free to schools.

ENC Demonstration Sites

Located throughout the country, these 12 sites are located at or in conjunction with the 10 Eisenhower Regional Consortia (see inside back cover), at the Capital Collection & Demonstration Site at George Washington University in Washington, DC, and at ENC. Teachers and other educators can visit or contact the Site in their area for a complete demonstration of ENC's services as well as assistance in locating educational materials and using new technologies.

Teacher contributions to ENC

To create a better service, ENC needs the help of the Nation's educators. ENC Online's newest tool, the Professional Development Exchange, offers one place where educators can both submit and search for professional development events and opportunities, such as workshops, conferences, or grant monies. However, this tool will only be useful if educators use and contribute to it. For more information, visit ENC Online at <http://www.enc.org>.

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U. S. Department of Education	***Office of Educational Research and Improvement***	***Office of Reform Assistance and Dissemination***
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Calculator-Active Materials

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About ENC Focus

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To request copies of any issue of the *Focus* series, contact ENC at the address above, or send e-mail to editor@enc.org. While some issues are out of print, all issues of this series are available online or on CD-ROM.

Past titles include *Equity in the Classroom, Earth Day in the Classroom, Real Data Resources for Teachers, Active Learning with Hands-on Resources, Integrating Math and Science,* and *New Approaches to Assessment in Science and Mathematics.*

How to Connect to ENC Online

To connect to ENC Online via the Internet, visit ENC's World Wide Web site at: <http://www.enc.org>. You can also telnet to enc.org; via modem dial (800) 362-4448 or (614) 292-9040. Set your communication software to VT100 terminal emulation, no parity, 8 data bits, 1 stop bit, and full duplex. Once connected, press <RETURN> to bring up a screen and type c to connect. All the information you need to use ENC is on the screen.

ENC Reference Services

Teachers with questions about math or science curriculum resources can call the ENC reference staff. Reference services include locating suitable teaching materials, identifying Federally-funded programs and opportunities, and making the best use of ENC's online services and Resource Finder, ENC's catalog of curriculum resources. Call the Reference Desk at ENC's toll-free number or dial (614) 292-9734. Send e-mail questions to library@enc.org.

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ENC FOCUS
Calculator-Active Materials

Do you remember a time when calculators were large and cumbersome and their cost was prohibitive for the average student? What mathematical skills were required of students at that time? What mathematical skills did employers expect their employees to have? Has that changed today?

One of the first questions asked of mathematics teachers—in both professional and social settings—is, "What do you think of using calculators in the classroom?" Typically, this is followed with a scenario such as, "I was in a fast food restaurant the other day, and the clerk had a difficult time making change for me because the computer was down." When arithmetic computation is considered the primary function of mathematics, calculators are viewed as crutches that hamper or even prevent learning.

The emphasis of mathematics instruction has changed from what it was twenty years ago. In today's workplace, the primary focus is on problem solving rather than on performing routine computations. Furthermore, employers now expect their employees to be able to use technology as an aid to problem solving. For efficiency as well as accuracy, routine functions involving large-number computation are expected to be performed on a calculator rather than with paper and pencil. The National Council of Teachers of Mathematics (NCTM) "recommends the integration of the calculator into the school mathematics program at all grade levels in classwork, homework, and evaluation." There is concern that schools may be unnecessarily spending a lot of time practicing computation rather than developing student understanding of mathematical concepts, problem-solving strategies, reasoning, patterns and relationships, and general use and application of mathematics.

Contrary to popular belief, students can actually learn basic computation skills by using the calculator, as long as they are taught to use it effectively. They can also learn estimation skills and the ability to judge the reasonableness of their solutions, which require both an understanding of operations and a knowledge of basic facts. In the article "Research Gives Calculator a Green Light," published in the September 1986 issue of *Arithmetic Teacher*, Ray Hembree analyzed 79 research studies and concluded that "in grades K–12 (except grade 4), students who use calculators in concert with traditional instruction maintain their skills with paper and pencil without apparent harm." It was also found that using calculators could actually improve the average student's basic skills, and that students who use calculators have better attitudes toward mathematics than those who do not.

This issue features both the calculators themselves and the activity books that are to be used with them (called "calculator-active" resources in ENC's Resource Finder). Among the calculators included here are those that display fractions in improper, mixed, and reduced forms; graph functions in several colors; or perform symbolic algebraic, differential, and integral manipulations. Also highlighted are calculators that allow students to explore interactive geometry and to incorporate real-world data through connection with a data collection system.

Some of the activity books covered integrate the use of manipulatives with calculators and employ the calculator as a teaching tool rather than just as a method of checking answers and computing with large numbers. Activity books are available for both the kindergarten teacher and the calculus teacher, offering a variety of activities ranging from those that teach number sense to activities that foster explorations of patterns and relationships in functions.

The resources described in this issue were found using Resource Finder, ENC's searchable online catalog of curriculum resources (see "How to Connect to ENC Online" on p. 1). The search was performed using subject identifiers such as "calculators" and "graphing," and using the Resource Type "calculator-active." Identifiers such as "fractions," "data collection," "geometry," and "functions" can help narrow the search.

Calculator-Active Materials

Items Featured in This Issue

Pricing and ordering information were verified in February of 1997 and are subject to change.

Title	Grades	Price	Pg
The Educator Elementary Overhead Calculator	K–6	$43.50	4
Texas Instruments Explorer Plus Calculator	5–10	Dealers set prices	5
fx-55 Calculator	1–8	$24.95	6
EL-E300 Electronic Calculator	5–8	$34.95 *	7
TI-80 Graphics Calculator	7–12	Dealers set prices	8
TI-108 Calculator	K–6	Dealers set prices	9
Calculator-Based Laboratory (CBL) System	7–12	Dealers set prices	10
TI-83 Graphing Calculator	5–12	Dealers set prices	11
CFX-9800G Calculator	8–12	$129.95 *	12
EL-9300C Graphing Scientific Calculator	9–12	$74.95 *	13
TI-92 Graphing Calculator	9–12	Dealers set prices	14
Advanced Algebra through Data Exploration: A Graphing Calculator...	10–12	$14.95 (teacher ed.) $24.95 (student ed.)	15
Algebra for Everyone	6–9	$47.50 *	16
Calculator-Based Laboratory Video Workshop	8–12	$39.95	17
Creative Mathematics Teaching with Calculators: Explorations and...	PreK–10	$10.95	18
Calculus Investigations with the HP-48G/GX	11–12	$19.95	19
Explorations in Precalculus for the TI-82	10–12	$19.95	20
Graphic Algebra: Explorations with a Function Grapher	8–10	$34.95 (teacher ed.) $24.95 (student ed.)	21
Linear Correlation Study: The Integration of Mathematics and Biology	8–10	$2.00 *	22
The MathMate Activity Book, Level 1	K–1	$10.95	23
Matrices and Discrete Mathematics: Models You Can Count on	5–12	$14.95	24
Maneuvers with Number Patterns: Student Lab Book	5–8	$16.25 (teacher ed.) $5.75 (student ed.) *	25
Precalculus Mathematics: A Graphing Approach	11–12	$58.88 (teacher ed.) $49.92 (student ed.)	26
TOPS Calculator Problem Deck III	3	$42.50	27
Uncovering Mathematics with Manipulatives and Calculators: Levels 2 & 3	2–6	$19.95	28
Using the Calculator to Develop Multiplication and Division...	4–8	$6.75	29
Young Children Using Calculators	PreK–3	Contact publisher for information	30

** Please see record for details*

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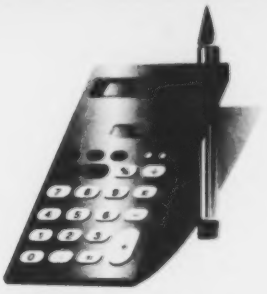
Calculators for Grades K–8



Creative Publications
5623 West 115th Street
Worth, IL 60482
Toll-free no.: (800) 624-0822
Fax no.: (800) 624-0822
1 Educator Elementary Overhead Calculator:
Order no.: 32906K $43.50

The Educator Elementary Overhead Calculator

1991

Grade levels: *K–6*

Subjects Arithmetic; Calculators; Computation; Educational technology; Mathematics.

Abstract *This overhead calculator is designed to be compatible with the* TI MathMate *and exactly duplicates the functions, key locations, and displays of the student hand-held version. The calculator performs the four basic arithmetic operations, features parentheses keys to define the order of operations, and contains memory. It is solar powered, with a large display screen and a color-coded keyboard. Reference manuals are provided in both English and Spanish and describe key strokes for various functions. (AM)*

Author Stokes Publishing Company

Reference No. ENC-001140

Note Also available:
The Educator Intermediate Overhead Calculator, for grades 5–8.
Order number 32928K, $84.50
ENC-001141

Texas Instruments, Inc.
Customer Relations
P.O. Box 6118
Temple, TX 76503-6118
Toll-free no.: (800) 842-2737 [(800) TI-CARES]
1 TI Explorer Plus Calculator:
TI indicates that dealers set prices.

Texas Instruments Explorer Plus Calculator

1995

Grade levels: *5–10*

Subjects

Arithmetic; Calculators; Educational technology; Fractions; Mathematics.

Abstract

This solar-powered calculator can manipulate and compute operations with fractions, perform basic scientific and trigonometric functions, and generate random numbers. It also performs one-variable statistics, symbolizes and manipulates pi, and expresses division problem results as quotients and remainders rather than just in decimal format. Calculations are performed using the standard algebraic rules. The calculator stores up to five pending operations and 15 levels of open parentheses. A teacher's guide with worksheets is included to help students use the calculator to solve certain types of math problems. Answers to the worksheets are provided. Each chapter contains transparency masters that illustrate practical applications of the keys being learned. Error messages may be displayed on a transparency and discussed. (Author/LDR)

Author

Texas Instruments, Inc.

Reference No.

ENC-005507

Source Note

Gift of Texas Instruments, Inc.

Note

Using the Explorer Plus: A Guide for Teachers was developed by Cathy Cromar, Stephen Davies, Gary Hanson, Jane Martain, Trudy Okada, Aletha Paskett, and Claudia Schmitt.

Casio, Inc.
570 Mount Pleasant Avenue
Dover, NJ 07801
Telephone no.: (201) 361-5400
Fax no.: (201) 361-3819
1 fx-55 Calculator: $24.95

fx-55 Calculator

1995

Grade levels: *1–8*

Subjects Arithmetic; Calculators; Educational technology; Fractions; Mathematics.

Abstract *This calculator, for teachers and students in grades 1–8, performs the standard arithmetic operations as well as calculations involving fractions, pi, square roots, constants, reciprocals, percent, and exponents. It also generates random numbers and has memory storage and recall. Fractions can be simplified step by step to their lowest common denominator and the reduction factor can be displayed. Calculations with parentheses are possible. At the touch of a key, the calculator can perform conversions between improper fractions and mixed numbers and between fractions and decimals. The fraction display shows numerator over denominator just as it is written in textbooks. It is possible to show the integer quotient and the remainder on the same screen by using the division with remainder key. The screen displays eight characters per line, and in fraction mode it displays two lines to allow for exhibiting both the numerator and denominator. When more than eight digits are required, entries and answers can be written in exponential notation. Operation instructions are written in English, French, and Spanish. (Author/LDR)*

Author Casio, Inc.

Reference No. ENC-003790

Source Note Gift of Casio, Inc.

Sharp Electronics Corporation
Sharp Plaza
P.O. Box 650
Mahwah, NJ 07430-2135
Telephone no.: (201) 529-6329
1 EL-E300 Electronic Calculator: $34.95
Note: Mention ENC to receive above price.

EL-E300 Electronic Calculator

1992

Grade levels: *5–8*

Subjects Algebra; Arithmetic; Calculators; Educational technology; Fractions; Mathematics; Statistics.

Abstract *This calculator, intended for teachers and students in grades 5–8, performs the standard arithmetic operations as well as calculations involving fractions, pi, square roots, and statistics. It can also work problems that involve an integer quotient and remainder and determine the greatest common factor and least common multiple. The screen represents characters and problems with the symbols students would use when writing their calculations by hand. For example, square roots are displayed as radical signs and radicands, exponents as superscripts, and proper fractions as numerators over denominators. At the touch of a button, rational numbers can be converted from improper fractions to mixed numbers to decimal representations (in any order), or proper fractions can be changed to decimal representations. The integer divide key displays the integer quotient and remainder. The calculator will accept up to 80 characters and the screen displays 12 characters per line, with two lines in fraction mode to allow for both the numerator and denominator. Equation playback recalls equations displayed in previous calculations. The resource book includes practice and assigned problems and contains blackline masters for each type of learning activity. Correlation to the National Council of Teachers of Mathematics (NCTM)* Curriculum and Evaluation Standards for School Mathematics *(1989) is indicated for each activity. (Author/LDR)*

Standards NCTM Standards (1989). Content Standards: Grades 5–8
Mathematics as problem solving; Mathematics as communication; Mathematics as reasoning; Mathematical connections; Number sense and number relationships; Number systems and number theory; Computation and estimation; Patterns and functions; Algebra; Statistics; Probability; Geometry; Measurement.

Author Sharp Electronics Corporation

Reference No. ENC-003192

Source Note Gift of Sharp Electronics Corporation

Note *User's Guide and Teaching Activities for the Classroom* developed and written by David Stout.

Texas Instruments, Inc.
Customer Relations
P.O. Box 6118
Temple, TX 76503-6118
Toll-free no.: (800) 842-2737 [(800) TI-CARES]
1 TI-80 Graphics Calculator:
TI indicates that dealers set prices.

TI-80 Graphics Calculator

1995

Grade levels: *7–12*

Subjects Arithmetic; Calculators; Educational technology; Graphing; Fractions; Mathematics; Statistics.

Abstract *This graphing calculator performs the standard arithmetic operations as well as logarithmic, exponential, trigonometric, and hyperbolic trigonometric functions. Expressions are evaluated according to standard mathematical priorities and parentheses are used for grouping. Up to eight 16-character lines can be displayed and multiple instructions can be entered on the same line. A replay feature allows users to check and edit their last entry. Numerical values and tables of values can be stored for later recall. Many options can be accessed through a menu-driven interface. As many as four rectangular functions and three parametric equations can be defined, stored, graphed, and analyzed. The graphs can be annotated and the size and scale of the viewing window can be adjusted. Users can trace along a displayed graph while viewing the coordinates of each point. A function evaluation table shows numeric output in table format. Intersections of inequalities can be shown using vertical, horizontal, and diagonal shading patterns. Data can be input in tables of up to six columns, with a possible total of 99 elements per column. Other analysis features include four plot types, such as histograms, scatter plots, xy lines, or box and whisker plots, and one and two variable statistical analysis with five regression models. The calculator can store up to three definitions of statistical drawings. Programs that facilitate extensive control and include input and output functions can be entered and stored. In addition, programs can be accessed as subroutines from other programs. Users can enter fractions at the keyboard, perform calculations with them, and convert between fractions, mixed numbers, and decimals. Mode settings allow automatic or step-by-step simplification of fractions to lowest terms. A user's guide is also included. (Author/DDD)*

Author Texas Instruments, Inc.

Reference No. ENC-002881

Source Note Gift of Texas Instruments, Inc.

Note Guidebook developed by the staff of Texas Instruments Instructional Communications, 1995.

Texas Instruments, Inc.
Customer Relations
P.O. Box 6118
Temple, TX 76503-6118
Toll-free no.: (800) 842-2737 [(800) TI-CARES]
1 TI-108 Calculator set:
TI indicates that dealers set prices.

TI-108 Calculator

Series: *Calculators for School*

1991

Grade levels: *K–6*

Subjects Arithmetic; Calculators; Discovery learning; Educational technology; Mathematics.

Abstract *This solar-powered calculator performs the standard arithmetic operations and also calculates percents and square roots. When the memory key is pressed, numbers may be grouped and saved for later operations; otherwise, the calculator processes operations as they are keyed in, rather than processing multiplication and division before addition and subtraction. The last number and operation entered are automatically stored so that each time the equal key is pressed, the last action is repeated. There is a three-key memory and the calculator has the capability to clear the last entry or all entries. Keys are grouped and color-coded (red or white) by related functions. The calculator comes with student lessons that are designed to introduce elementary mathematics students to the calculator and to help them use it as a tool for exploring concepts. Each lesson is independent of the others and features a guide and one or more transparency masters. Many lessons offer activity sheets with answers. The lessons are printed in both English and Spanish. (Author/DDD)*

Author Texas Instruments, Inc.

Reference No. ENC-002891

Source Note Gift of Texas Instruments, Inc.

Calculators for Grades 9–12

Texas Instruments, Inc.
Customer Relations
P.O. Box 6118
Temple, TX 76503-6118
Toll-free no.: (800) 842-2737 [(800) TI-CARES]
1 CBL unit: TI indicates that dealers set prices.

Calculator-Based Laboratory (CBL) System

1994

Grade levels: *7–12*

Subjects Algebra; Applied math; Biological sciences; Biology; Calculators; Calculus; Chemistry; Data collection; Educational technology; Mathematics; Physical sciences; Physics; Real data; Science; Statistics.

Abstract *This hand-held, calculator-based data collection system is designed for math and science students in high school and college. A Texas Instruments* TI-82 *or* TI-85 *graphing calculator is used to set up the data collection parameters, which are communicated to the* CBL. *Students can then disconnect the* CBL, *allowing it to act as a stand-alone data collection device. Once the data is collected, students can reconnect the* CBL *to the calculator to retrieve and analyze data. The* CBL *can be left connected during data collection, or it can be used as a stand-alone multimeter for measuring voltage, resistance, motion data and more. It can also measure internal battery voltage. Students can gather a variety of real-world data using probes, three of which are included: temperature, light, and voltage. An optional adapter (not included) provides compatibility with many other probes, making it possible to measure force, sound, pH, and other characteristics and phenomena. The* CBL *computes first and second derivatives on collected data as well as minimum, maximum, mean, and standard deviation statistics values. As data is collected, the* CBL *records absolute or relative time. Data smoothing algorithms are built in. Information can be collected on up to five channels simultaneously and at rates of 10,000 points per second, for a total of 512 points per channel. Users can collect data real time at rates of up to 14 points per second with the* TI-82 *and 12 points per second with the* TI-85. *The unit comes with a guidebook and a workbook of classroom experiments for physics, math, and chemistry. (Author/MPN)*

Standards NCTM Standards (1989)

Equipment Requires 4 AA batteries; *TI-82, TI-85,* or *TI-85/CBL* calculator

Author Texas Instruments, Inc.

Reference No. ENC-002935

Source Note Gift of Texas Instruments, Inc.

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Texas Instruments, Inc.
Customer Relations
P.O. Box 6118
Temple, TX 76503-6118
Toll-free no.: (800) 842-2737 ([800] TI-CARES)
1 TI-83 Graphing Calculator:
TI indicates that dealers set prices.

TI-83 Graphing Calculator

1996

Grade levels: *5–12*

Subjects

Algebra; Calculators; Calculus; Educational technology; Graphing; Linear algebra; Mathematics; Matrices; Programming; Sequences; Statistics.

Abstract

This calculator performs the standard arithmetic operations as well as logarithmic, exponential, trigonometric, and hyperbolic trigonometric functions. Multiple instructions can be entered on the same line, and the screen can display a total of eight 16-character lines. Numerical values and tables can be stored for later recall. Many options can be accessed through a menu-driven interface. Up to 10 rectangular functions, six polar equations, six parametric equations, and three recursively defined sequences can be defined, saved, and graphed. The graphs can be annotated and the size and scale of the viewing window can be adjusted. A split screen option allows users to view the graph screen and a related editor simultaneously. Users can trace along a displayed graph while viewing the coordinates of each point. Users can interactively analyze function values, roots, maximums, minimums, integrals, and derivatives. Sequences can be generated and plotted over time or as cobweb, stair step, or phase plots. As many as 10 matrices can be stored and standard matrix operations can be performed. Up to 10 string variables may be stored for display or used with string functions. A maximum of six tables of statistical data can be entered and one and two variable analyses performed, including median-median line and regression analysis. This data can be plotted in histograms, scatter plots, xy lines, modified or regular box and whisker plots, or normal probability plots. Up to three statistical plot definitions can be saved for future use. As many as 16 inferential statistics tests may be performed, including z and t tests, the Chi square test, and one way analysis of variance (ANOVA). These tests can be performed for known or unknown standard deviations. Programs that facilitate extensive control, such as input and output functions, can be entered and stored for future use. Financial functions include computations for amount of payment, future value, amortization schedule interest sum, nominal interest rate, and effective interest rate. The CATALOG option allows access to an alphabetical list of most functions and instructions. An input/output port and link cable allows information to be shared with another TI-83 and received from a TI-82. Information can also be printed or stored on an IBM or Macintosh compatible computer by using the optional TI Graph Link software and cables (not included). A user's guide is provided. (Author/DDD/LDR)

Author

Texas Instruments, Inc.

Reference No.

ENC-007159

Source Note

Gift of Texas Instruments, Inc.

Casio, Inc.
570 Mount Pleasant Avenue
Dover, NJ 07801
Telephone no.: (201) 361-5400
Fax no.: (201) 361-3819
1 CFX-9800G Calculator: $129.95
Note: Mention ENC to receive above price.

CFX-9800G Calculator

1995

Grade levels: *8–12*

Subjects Algebra; Calculators; Calculus; Complex numbers; Educational technology; Graphing; Linear algebra; Mathematics; Matrices; Number systems; Polar coordinates; Programming; Science; Statistics; Tables.

Abstract *This calculator performs the standard arithmetic operations as well as logarithmic, exponential, trigonometric, and hyperbolic trigonometric functions. Many options may be accessed through the 12 modes available from the screen menu. One of these modes, BASE, performs logical operations and calculates and converts between binary, octal, decimal, and hexadecimal numbers. A second mode, REG (regression), analyzes and draws paired variable statistical graphs, while a third, DYN (dynamic), changes the graph of a function, such as y=ax2 as the value of a ranges from 1 to a given number. TABLE stores and generates changes for functions or recursion formulas, and EQUA (equation) solves simultaneous linear equations with two to six unknowns as well as quadratic equations or cubic equations. The complex key performs arithmetic operations with complex numbers and calculates the square root, reciprocal, absolute value, and conjugate. Up to 30 rectangular functions, polar equations, and parametric equations may be saved for graphing. Students can use the calculator to display histograms, dots, cumulative frequency, normal distributions, and inequalities. Single and paired variable statistical graphs and data analysis are possible. The section of the graph to be viewed is adjustable, and users may trace the graph while examining the coordinates of each pixel. Color capabilities include overwriting multiple graphs in different colors, color coding graphs and their formulas, shading, tracing, and color box zooming. Up to 26 matrices may be stored and used with the standard matrix operations. Programs that facilitate extensive control, such as input and output functions, may be entered and stored for future use. Using the input/output port with a link cable (not included) allows information to be shared with another CFX 9800G calculator or printed on a Casio label printer. Another cable (not included) connects the calculator with an IBM or a Macintosh computer, and a screen option allows the user to print the current screen. The calculator includes a user's manual. (Author/LDR)*

Author Casio, Inc.

Reference No. ENC-003789

Source Note Gift of Casio, Inc.

15

Sharp Electronics Corporation
Sharp Plaza
P.O. Box 650
Mahwah, NJ 07430-2135
Telephone no.: (201) 529-6329
1 EL-9300C Graphing Scientific Calculator:
$74.95
Note: Mention ENC to receive above price.

EL-9300C Graphing Scientific Calculator

1992

Grade levels: *9–12*

Subjects Algebra; Calculators; Calculus; Data analysis; Educational technology; Graphing; Linear algebra; Mathematics; Matrices; Polar coordinates; Programming; Sequences; Statistics.

Abstract *This calculator performs the standard arithmetic operations as well as logarithmic, exponential, trigonometric, and hyperbolic trigonometric functions. As many as 160 characters can be written on one line, including multiple instructions such as different operations. The calculator displays up to 10 characters in the result while retaining 14 digits in memory. At least 27 numerical values can be stored for later recall. Many options can be accessed through a menu-driven interface. Up to four rectangular functions, two polar equations, and two pairs of parametric equations may be defined, saved, and graphed. The graphs can be annotated and the size and scale of the viewing window is adjustable. Users can trace a displayed graph while viewing the coordinates of each point. The calculator can analyze function values, roots, maximums, minimums, integrals, and derivatives. Sequences can be generated and plotted over time. As many as 26 matrices may be stored for use with the standard stored matrix operations. The statistical mode can display six different graphs: histograms, broken line, cumulative frequency, normal distributions, scatter diagrams, and box charts. It can also display six types of regression curves, such as linear, exponential, logarithmic, log base ten, power, and inverse. Users can enter statistical data and perform one or two variable analyses on it. Programs that facilitate extensive control, such as input and output functions, can be entered and stored for future use. An input/output port and link cable (not included) allows information to be shared with another EL-9300C or a cassette tape. The calculator has a screen option that allows users to print the current screen using a Sharp CE 50P printer and the link cable. A user's guide is included. (Author/LDR)*

Standards NCTM Standards (1989). Content Standards: Grades 5–8, Grades 9–12

Author Sharp Electronics Corporation

Reference No. ENC-003191

Source Note Gift of Sharp Electronics Corporation

Texas Instruments, Inc.
Customer Relations
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Toll-free no.: (800) 842-2737 [(800) TI-CARES]
1 TI-92 Graphing Calculator:
TI indicates that dealers set prices.

TI-92 Graphing Calculator

1995

Grade levels: *9–12*

Subjects Algebra; Calculators; Calculus; Educational technology; Geometry; Graphing; Mathematics; Polar coordinates; Programming; Statistics; Transformation; Vectors.

Abstract *This calculator performs symbolic manipulation for algebra and calculus expressions and equations and links to the* Calculator-Based Laboratory (CBL) *(sold separately) in order to analyze real-world data. It permits interactive exploration of Euclidean, transformational, and analytic geometry and provides three-dimensional surface plots for exploring complex algebraic expressions. Included is the full QWERTY keyboard and editing features such as* cut, copy, paste, *and* find. *A feature called* pretty print *shows equations and results with radical notation, stacked fractions, and superscript exponents. A menu-driven interface provides seven menus containing more than 40 options. The programming format includes parameter passing and allows for local and global variables to be managed from within a program. Up to 99 equations, such as parametric equations, piecewise defined functions, and polar equations, may be defined, saved, and graphed. These graphs may be annotated, and the size and scale of the viewing window can be adjusted. Users can trace a displayed graph while viewing the coordinates of each point and can also magnify a selected portion of the graph. A split screen option allows users to view the graph screen and a related editor simultaneously. Users can interactively analyze function values, roots, maximums, minimums, integrals, and derivatives. Sequences can be generated and plotted over time. Standard matrix operations can be performed and matrix elements can be real or complex and numeric or symbolic. Users can enter statistical data and perform one and two variable analyses, including median-median line and regression analysis. This data can be plotted in histograms, points, xy lines, or box and whisker plots. Answers may be displayed as mixed or improper fractions or as decimals. An optional overhead view screen is available for classroom use. Information can be shared with another* TI-92 *through an input/output port and link cable. The optional* TI Graph Link *software and cables (sold separately) can be used to print or store information on an IBM or Macintosh compatible computer. A user's guide is included. (Author/LDR)*

Author Texas Instruments, Inc.

Reference No. ENC-006438

Source Note Gift of Texas Instruments, Inc.

Note The *TI-92 Geometry* was jointly developed by TI and the authors of *Cabri Geometry II*, at the Université Joseph Fourier, Grenoble, France. The *TI-92 Symbolic* manipulation was jointly developed by TI and the authors of the DERIVE program, at Soft Warehouse, Inc., Honolulu, HI.

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Advanced Algebra through Data Exploration: A Graphing Calculator Approach

1996

Grade levels: *10–12*

Subjects Algebra; Applied math; Calculators; Communication; Data analysis; Discrete math; Educational technology; Graphing; Integrated/Interdisciplinary approaches; Mathematics; Problem solving; Real world problems.

Abstract *This student book is a preliminary edition designed to implement the NCTM* Curriculum and Evaluation Standards *(1989), particularly mathematical reasoning, communication, experimentation, modeling, and symbolic manipulation in a real-world context. Another goal is to integrate algebra with statistics, data analysis, functions, discrete mathematics, geometry, probability, and trigonometry. To accomplish these goals, the book advocates incorporating graphing calculators into the learning process so that discrete mathematical topics such as recursively defined routines, parametric representations, random process simulations, and matrices may become part of the course. The book makes use of investigations and experiments to explore mathematical patterns, ideas, and relationships. Separate teacher's materials include objectives and section notes, as well as suggested assignments, activities, and answers to student exercises. It is intended that as students complete these exercises, they will both learn algebra concepts and appreciate the importance and value of what they are learning. (Author/LDR)*

Standards NCTM Standards (1989)

Author Jerald Murdock, Eric Kamischke, Ellen Kamischke

Reference No. ENC-005748

Source Note Gift of Key Curriculum Press

Note The preliminary edition of *Advanced Algebra Through Data Exploration: A Graphing Calculator Approach* has been classroom tested for four years.

Funding National Science Foundation (NSF)

National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22091
Telephone no.: (703) 620-9840
Toll-free no.: (800) 235-7566
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1 set (videotape, discussion guide):
Stock no: 032ENC $47.50
Note: 20% discount to NCTM members

Algebra for Everyone

1991

Grade levels: *6–9*

Subjects Algebra; Calculators; Cooperative learning; Core curriculum; Discovery learning; Educational technology; Graphing; Instructional improvement; Manipulatives; Mathematics; Pedagogy; Problem solving; Professional development; Reform; Teaching methods.

Abstract *This video and accompanying booklet provide algebra teachers with models of instruction that incorporate the use of manipulatives, cooperative groups, and graphing calculators in the development of algebraic concepts and problem solving skills. They are based on the recommendations in* Curriculum and Evaluation Standards for School Mathematics *(1989) of the National Council of Teachers of Mathematics, which proposes that all students study the same basic core curriculum. By showing excerpts of lessons taught by a mathematics teacher in an ordinary classroom, the video's producers hope to promote discussion on needed changes in instructional methods, student behavior, and mathematical content. The booklet contains three lesson plans modeled on the video and four additional plans designed to reinforce the exemplified teaching techniques. Each lesson plan includes objectives, needed materials, exploratory activities, and worksheets. Lessons provide hands-on activities, such as having students build a variety of model staircases and then calculate and predict surface areas and volumes of actual staircases. Other activities have students explore linear and quadratic equations using graphing calculators and use manipulatives to develop algorithms for addition and subtraction of integers. Students are also given an opportunity to use algebra tiles in demonstrating the multiplication and factoring of binomials. (AM)*

Standards NCTM Standards (1989)

Author Mathematics Education Trust; National Council of Teachers of Mathematics

Reference No. ENC-000001

Source Note Gift of the National Council of Teachers of Mathematics

Funding Domino's Pizza, Inc.

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1 training kit: $39.95
Note: CBL unit needed as well. Available from Wholesale Electronic Supply, Inc. for $172.00

Calculator-Based Laboratory Video Workshop

1995

Grade levels: *8–12*

Subjects

Algebra; Biological sciences; Biology; Calculators; Chemistry; Data analysis; Educational technology; Integrated/Interdisciplinary approaches; Mathematics; Physical sciences; Physics; Prealgebra; Precalculus; Regression; Science; Statistics.

Abstract

This video, intended for students in algebra through calculus, uses the Texas Instruments TI-82 *calculator and the* Calculator-Based Laboratory *(CBL) to present real-world applications of mathematical concepts. The video demonstrates how this equipment collects, displays, and graphs data as well as finds equations that closely approximate the graphed data. Experiments found in the* CBL System *may be downloaded to the calculator from the enclosed computer disks. The* CBL *is a hand-held, calculator-based data collection system that uses probes to gather a variety of real-world data. A* TI-82 *graphics calculator is used to set up the data collection parameters via programs that are communicated to the* CBL. *The video covers mathematics concepts that have to do with graphing, such as linear, quadratic, exponential, natural logarithmic, and power regressions. Science concepts discussed include voltage, temperature, pressure, and sound sensors. In addition, the video covers the use of various equipment, including a motion detector, heart rate monitor, light intensity sensor, and pH probe. (Author/MPN/LDR)*

Author

Director and audio, John Roman; executive producer, Dennis Redman; programming, Chris Brueningsen; presented by Wholesale Electronic Supply, Inc.; production of ECI Video

Reference No.

ENC-005843

Source Note

Gift of Wholesale Electronic Supply, Inc.

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Creative Mathematics Teaching with Calculators: Explorations and Investigations

1992

Grade levels: *PreK–10*

Subjects Calculators; Discovery learning; Educational technology; Estimation; Mathematics; Mental computation; Patterns; Pedagogy; Professional development.

Abstract *This book is intended to help teachers at all levels develop a positive attitude toward the use of calculators in the mathematics classroom. It was designed to reflect the recommendations on the appropriate use of technology as outlined in the* Professional Standards for Teaching Mathematics *(1992) from the National Council of Teachers of Mathematics. Author David Williams discusses how to teach mathematics with calculators, focusing on discovery and exploration, and offers a variety of activities and investigations that also give guidance on teaching mathematics in general. For each activity, there is a section that discusses background information, needed materials, suggested prerequisite skills, and recommended grade levels. The procedure portion of each activity suggests a script to use in presenting the lesson, while the follow-up section includes ways that the activity can be extended. One of the chapters of the book features seven motivational activities that deal with problem solving and pattern exploration. Other chapters focus on mental math, estimation activities, and games. (Author/DDD)*

Author David E. Williams

Reference No. ENC-002819

Source Note Gift of Stokes Publishing Company

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1 text: ISBN 1-886801-18-5 $19.95

Calculus Investigations with the HP-48G/GX

1995

Grade levels: *11–12*

Subjects Calculators; Calculus; Derivatives; Educational technology; Integrals; Graphing; Mathematics; Pedagogy.

Abstract *This textbook supplement for courses in single variable calculus describes integrating the* HP-48G/GX *graphing calculator into the teaching and learning of calculus. Emphasizing the calculator's numerical, graphical, and symbolic processing capabilities, the book advocates a course of study that focuses on examples, classroom discussions, and calculator activities, rather than a course that is more traditional, abstract, and proof-oriented. For example, the activity called Piecewise Differentiation notes that, although a graphing calculator will not completely symbolically differentiate a function defined with the IFTE (an abbreviation for if... then... else... end construction) command, it will correctly plot the derivative. The calculator buttons needed for this and other commands are stated and displayed in each section. (Author/LDR)*

Author Donald R. LaTorre

Reference No. ENC-005582

Source Note Gift of Charles River Media, Inc.

Funding National Science Foundation (NSF)

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1 text/disk set: ISBN 0-963-9121-3-5 $19.95

Explorations in Precalculus for the TI-82

Series: *CBL Exploration Series*

1995

Grade levels: *10–12*

Subjects

Calculators; Data analysis; Data collection; Educational technology; Force; Functions; Graphing; Light; Mathematics; Motion; Physical sciences; Physics; Proportions; Real data; Science; Sequences; Sound; Statistics; Trigonometry; Vectors; Velocity.

Abstract

This book contains 17 experiments and investigations intended to teach precalculus students how to collect physical data using a Texas Instruments Calculator-Based Laboratory System *(not included) and* TI-82 *graphing calculator (not included). Sensors and probes needed for the experiments include Vernier's motion detector, force sensor, pressure sensor, magnetic field sensor, and microphone, as well as Texas Instruments' light probe and temperature probe. Each exploration includes an introduction, specific details regarding equipment and setup, and instructions for performing the experiment. After completing each experiment, students are asked to record results, analyze collected data, and write conclusions. Several of the activities suggest further explorations. Experiments include exploring objects in motion, rates at which water drains, light intensity, and the relationship between the pressure of a trapped gas and its volume. Students also have the opportunity to study the temperatures of a cooling object, the nature of musical sounds, and the motion of simple pendulums. Each exploration includes a* TI-82 *program. These programs are also provided on a floppy disk and can be transferred from a computer to the* TI-82 *using* TI Graph Link *(optional). The book is designed to follow the natural progression in the study of precalculus and does not require a specific precalculus textbook, but it does assume that the user is familiar with the* TI-82 *calculator. (Author/DDD)*

Author

Meridian Creative Group, a Division of Larson Texts, Inc.

Reference No.

ENC-002868

Source Note

Gift of Meridian Creative Group

Equipment

Requires: *CBL* unit; *TI-82* calculator; Vernier equipment (see abstract) and CBL DIN adapter. Other equipment varies but includes common items such as a basketball, a meter stick, a board, rubber bands, etc. Optional software: *TI Graph Link* from Texas Instruments may be used to download software from the supplied disk to the calculator.

Curriculum Corporation
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Carlton, Victoria 3053
AUSTRALIA
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1 teacher guide: ISBN 1 86366 289 8 $34.95
1 student text: ISBN 1-86366-288-X $24.95

Graphic Algebra: Explorations with a Function Grapher

1995

Grade levels: *8–10*

Subjects

Algebra; Calculators; Computers; Curriculum; Educational technology; Exponential functions; Functions; Graphing; Mathematical modeling; Mathematics; Pedagogy; Problem solving.

Abstract

This book for grades 8–10 describes a project at the University of Melbourne, Australia, to design and evaluate teaching materials that complement and extend student work in algebra. The book relies on graph-plotting software (not included) or a graphing calculator (not included) and provides instruction for the concepts and skills needed to use such equipment. One objective is to help students understand how families of functions behave. Graphs are used to teach properties of functions and solve problems from realistic contexts. Different representations are linked to help students learn to move easily between tables of values, algebraic expressions, and graphs. It is intended that this book will teach students to devise equations that represent situations, obtain solutions with a variety of methods, and represent data with a coordinate system. Another learning goal is that students will have the ability to plot, sketch, and interpret graphs in four quadrants, recognizing local and global features and identifying maxima and minima. Students should also be able to recognize and represent linear, reciprocal, quadratic, polynomial, and exponential functions in tables, symbols, and graphs. Teachers are given notes that address common difficulties encountered by students. They are also given field-tested hints for teaching the material. (Author/LDR)

Standards

Australia: National statement on mathematics for Australian schools

Author

Gary Asp, John Dowsey, Kaye Stacey, David Tynan

Reference No.

ENC-006771

Source Note

Gift of the Curriculum Corporation

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University of Southern Mississippi
P.O. Box 5045
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Telephone no.: (601) 266-5784
Fax no.: (601) 266-5818
Contact person is Lida McDowell
1 booklet: $2.00
Cash or Money Order ONLY.

Linear Correlation Study: The Integration of Mathematics and Biology

1994

Grade levels: *8–10*

Subjects Applied math; Biological sciences; Biology; Calculators; Data analysis; Golden rectangles; Graphing; Human body; Integrated/Interdisciplinary approaches; Linear relationships; Mathematics; Physiology; Plants; Science; Statistics.

Abstract *This set of graphing activities, developed for grades 8–10, allows students to gather biological data, analyze the data mathematically, render biological explanations, and use mathematical models to make predictions. Students use graphing calculators to determine if there is a linear relationship between the length and width of golden rectangles of varying dimensions and between sets of data that show positive, negative, or no correlation. Activity topics include the relationships between heart rate and age, between the height of corn seedlings and the number of days since planting, and between lung capacity and height. Also investigated is the amount of carbon dioxide given off by yeast grown in various concentrations of sucrose. The activities were developed based on the* NCTM Curriculum and Evaluation Standards (1989) *and the draft of the* National Science Education Standards *from the National Research Council. In addition to the activities, twelve statements are provided and students are asked to match each sentence to an appropriate graph. For example, the statement might be "You are watching an exciting movie; plot your heart rate (beats per minute) as a function of time." (VN/KSR)*

Standards NCTM Standards (1989)

Author Lida G. McDowell

Reference No. ENC-001587

Source Note Gift of Lida G. McDowell

Note This is an unpublished booklet.

Funding Mississippi Institutions of Higher Learning

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I text: ISBN 0-914534-04-1 $10.95

The MathMate Activity Book Level 1

1992

Grade levels: *K–1*

Subjects Arithmetic; Calculators; Computation; Fractions; Geometry; Logic; Mathematics; Measurement; Money; Operations; Place value; Problem solving; Professional development; Time.

Abstract *This book, the first in a series of three, is designed to help K–1 teachers use the Texas Instruments* MathMate *calculator (not included) as an effective instructional aid in teaching basic mathematics concepts. Among the topics addressed are number recognition, place value, counting, problem solving, estimation, measurement, and mental math. The book has an introductory section with instructions, suggestions, and examples to help teachers use the calculator in the primary curriculum. The remainder of the book contains lesson helpers with accompanying activity sheets. Included in the lessons are objectives, detailed procedures, answers, and extensions. This book also contains suggestions for using the* Educator Elementary Overhead Calculator, *which features the same keyboard and display as the* MathMate *and can be used with any overhead projector. (Author/DDD).*

Standards NCTM Standards (1989). Content Standards: Grades K–4

Author David E. Williams

Reference No. ENC-002755

Source Note Gift of Stokes Publishing Company

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Education Division
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1 videocassette set: $14.95

Matrices and Discrete Mathematics: Models You Can Count on

Series: *Teaching Mathematics with Calculators: A National Workshop*
1995

Grade levels: *5–12*

Subjects Calculators; Discrete math; Educational technology; Graphing; Instructional improvement; Mathematics; Matrices; Pedagogy; Professional development.

Abstract *This video and corresponding manual are designed to show mathematics teachers how graphing calculators, specifically the Texas Instruments TI-81 and TI-82, can be used in classroom instruction of discrete math and matrices. The video consists of a workshop and two classroom scenes. In the workshop, the speaker discusses classroom activities involving matrices and demonstrates how the graphing calculator can be used with these activities. The classroom scenes show similar activities being performed in school settings. In one of them, students consider an example of children passing notes to set up a matrix on the calculator. In another, data from a shampoo survey is used to multiply matrices on the graphing calculator. The manual details the activities presented in the video. (Author/KFR)*

Standards NCTM Standards (1989)

Author Project directors, John W. Kenelly and John G. Harvey; presented by Mathematical Association of America and National Council of Teachers of Mathematics

Reference No. ENC-002717

Source Note Gift of Wholesale Electronics Supply, Education Division

Funding National Science Foundation (NSF), Texas Instruments, Inc.

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Maneuvers with Number Patterns: Student Lab Book

Series: *Maneuvers with Mathematics Project*

1995

Grade levels: *5–8*

Subjects Calculators; Computation; Fractions; Educational technology; Geometry; Graphing; Mathematics; Number patterns; Problem solving.

Abstract *This teacher sourcebook and student lab book, designed for grades 5–8, advocate using full-function calculators as problem-solving tools. In activities that emphasize a hands-on approach, the books cover exploration, recognition, and interpretation of patterns, such as those in multiplication and addition tables, as well as in graphs, algebra, and geometry. The books can be used in large group settings or in small cooperative groups, and lessons can be stretched into larger investigations. The consumable student lab book contains multi-step problems, classroom activities, homework, and enrichment problems for students of varied ability levels. The teacher sourcebook contains transparency masters, tests, quizzes, answer keys, parent letters (in English and Spanish), and a teacher's guide. For each chapter of the student lab book, the teacher's guide provides an overview, preliminary skills activities, lesson plans, detailed hints and teaching notes, and lists of needed materials. It also contains pacing schedules for varying student ability levels, vocabulary lists, and optional supplemental activities. The goal of the series is to replace or supplement current mathematics units with calculator-based, problem-solving materials that are aligned with the NCTM* Curriculum and Evaluation Standards for School Mathematics (1989). *(Author/AM/MPN)*

Author David A. Page, Kathryn Chval

Reference No. ENC-002648

Source Note Gift of the University of Illinois at Chicago, Maneuvers with Mathematics Project (UIC MWM)

Support The Institute for Mathematics and Science Education at the University of Illinois at Chicago can assist schools in designing and/or presenting UIC MWM staff development programs.
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Funding National Science Foundation (NSF)

Language English; Spanish

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Precalculus Mathematics: A Graphing Approach

1994

Grade levels: *11–12*

Subjects Calculators; Educational technology; Functions; Mathematics; Precalculus; Problem solving; Real world applications; Trigonometry; Visualization.

Abstract *This textbook, designed to be used in a precalculus course, requires the use of a graphing calculator or computer graphing software in its application of a graphing approach to the curriculum. The authors propose that the use of graphing technology allows the focus of the course to be on problem solving and exploration, while building a deeper understanding of algebraic techniques. Significant to this approach is the use of algebraic, numeric, and graphical representations to develop concepts. The philosophy is that an abundance of quick, accurate graphs can be used to study the properties of functions and to enrich students' mathematical intuition. This approach also targets the development of student graphing ability through exploring geometric transformations. There is an emphasis on establishing a proper balance between exact answers and accurate approximation. Furthermore, the authors are interested in the development of students' ability to visualize mathematical properties with graphs. A three-step problem-solving process is used throughout the text. Students are asked to find an algebraic representation of a problem, a complete graph of that algebraic representation, and a complete graph of the problem-solving situation. The accompanying laboratory manual,* Graphing Calculator and Computer Graphing Laboratory Manual, *describes how to use various graphing calculators and computer graphing packages. (Author/GMM)*

Standards NCTM Standards (1989)

Author Franklin Demana, Bert K. Waits, and Stanley R. Clemens with assistance of Tommy Eads, Gregory D. Foley, Pamela Giles, and Diana Taggert

Reference No. ENC-006188

Source Note Gift of Franklin Demana and Bert K. Waits

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TOPS Calculator Problem Deck III

Series: *Techniques of Problem Solving*

1989

Grade levels: *3*

Subjects Arithmetic; Calculators; Computation; Fractions; Geometry; Logic; Mathematics; Mathematics skills; Measurement; Money; Operations; Place value; Problem solving; Time.

Abstract *This resource, part of a series of four card sets, is designed to demonstrate the power of the calculator as a problem-solving tool for students in grade 3. Like the other three decks in the series,* Deck III *contains 200 cards color coded to designate two levels of difficulty. The problems use skills and concepts drawn from numeration, whole number operation, time and money, measurement, geometry, fractions, and logic. The problems are intended to provide experience with five problem-solving skills: finding the information, choosing the operation, guessing and checking, organizing data, and using logic. These skills can be used singly or in combination. Each activity card contains student questions and diagrams. Most students will be able to work on four to six problems in one class period. There are five suggested activities for using these cards with students individually, in small groups, or in large groups. (Author/CCC)*

Author C. Greenes, G. Immerzeel, L. Schulman, R. Spungin

Reference No. ENC-001342

Texas Instruments, Inc.
7800 Banner Drive, MS3908
Dallas, TX 75251
Toll-free no.: (800) 842-2737 [(800) TI-CARES]
1 text: ISBN 886309-01-9 $19.95

Uncovering Mathematics with Manipulatives and Calculators: Levels 2 & 3

1995

Grade levels: *2–6*

Subjects

Calculators; Data analysis; Data collection; Educational technology; Geometry; Mathematics; Measurement; Number concepts; Patterns; Pedagogy; Probability; Problem solving; Statistics.

Abstract

This book gives teachers of students in grades 2–6 a series of mathematics activities that use calculators and manipulatives (not included). The activities are intended to help students develop positive attitudes toward the use of technology—not as a replacement for their mathematical thinking but as an extension of their mathematical power. The book uses the calculator as a data-generating device to support exploration of mathematical ideas. It covers such topics as number sense, patterns, relations, and functions, measurement and geometry, and probability and statistics. Each activity contains Teacher Pages that give directions and a student Recording Sheet that provides a method for organizing collected data. In one activity, students use the calculator to investigate the relationship between divisors and remainders in whole number division. In another, students use measuring tools and calculators to make half-sized drawings of themselves. Each activity is presented in both English and Spanish. (Author/KFR)

Standards

NCTM Standards (1989). Content Standards: Grades 5–8; Grades K–4

Author

Developed by Jane F. Schielack and Dinah Chancellor; design by Reecie Ross; contributions by Yolanda Andrade, Bob Fedorisko, Gay Riley-Pfund, Jan Stevens, Lynn Tanner, and Dianna Tidwell

Reference No.

ENC-003476

Source Note

Gift of Texas Instruments, Inc.

Language

English; Spanish

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Using the Calculator to Develop Multiplication and Division of Numbers in Grades 4 to 8

1989

Grade levels: *4–8*

Subjects Algorithms; Calculators; Computation; Division; Mathematics; Multiplication.

Abstract *This manual for teachers of grades 4–8 is designed to promote the use of calculators in teaching multiplication and division with whole numbers. In this monograph, author William Swart asserts that before doing paper and pencil exercises, students learn to use the calculator to estimate products and quotients and to perform all algorithm steps. After students understand the step-by-step processes, they are led to compute without the calculator. The manual suggests that points be allocated as rewards in various activities. Part 1 of the monograph covers multiplication, breaking it down into four distinct phases that gradually move the student away from reliance on the calculator and toward an understanding of the rote algorithm. Part 2 deals with division and is similarly presented in three teaching phases that can be used with both high-achieving and less proficient students. The manual provides examples of forms that students can use to learn the algorithms, as well as blackline masters of the worksheets. Sets of division problems are given at the end of the monograph. (Author/VN)*

Standards NCTM Standards (1989)

Author William L. Swart

Reference No. ENC-001686

Source Note Gift of Tricon Publishing, Inc.

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Young Children Using Calculators

1996

Grade levels: *PreK–3*

Subjects Arithmetic; Calculators; Computation; Counting; Educational technology; Mathematics; Number sense; Patterns; Pedagogy; Problem solving; Professional development.

Abstract *This 45-minute video shows how calculators have been used by teachers of grades K–3 to enhance children's learning of mathematics. The film was developed as a professional development tool by the Calculator in Primary Mathematics Project, funded by the Australian Research Council and the Deakin University Research Fund. It depicts teachers giving lessons in which the children were allowed or encouraged to use calculators. Having no previous experience with calculators, the children used them to count, explore and record numbers, solve real problems, and investigate patterns, as well as simply to amuse themselves. The teachers in the study shared how their teaching practices and beliefs were changed by using the calculators. They report that calculators add another dimension to students' experiences with numbers and that children are capable of understanding more about numbers than the teachers had previously thought. The teachers also indicate that using calculators frees children to explore what they want to know, since they are not limited to those numbers they can represent with their fingers or other counting tools. After participating in this study, the teachers reached the conclusion that teaching without calculators would be unfair to their students. (Author/GMM)*

Author Produced and scripted by Susie Groves and Jill Cheeseman; editing, Adrian Murrel-Barker and Malcolm Paul; director, Adrian Murrel-Barker; executive producer, Ed Brumby

Reference No. ENC-005781

Source Note Gift of the Deakin University

Funding Australian Research Council, Deakin University Research Fund

Professional Development Materials

These materials from the ENC collection are just a sampling of the resources available to help teachers understand how other educators use calculators in the classroom, how they can best be used, and why calculator use is beneficial and important to the improvement of math and science teaching. Most of these articles are available electronically from ENC both on the Internet and on CD-ROM. They can be found through the Resource Finder by entering the title or the ENC number. To find more materials for professional development in the ENC collection, try searching on the subject keywords "professional development" and "calculators." See "How to Connect to ENC Online" on p.1 or call ENC to learn how to get ENC's free CD-ROMs.

Promoting Calculator Use in Elementary Classrooms

Teaching Children Mathematics. Vol. 1, no. 5, January 1995 (p.300–305). Carola C. Drosdeck.

This article presents ways for elementary school teachers to promote the thoughtful use of calculators and to encourage students and parents to approach these mathematical tools with positive attitudes. Emphasis is placed on teaching children to value the calculator. The article also suggests how to determine when calculator use is appropriate and when mental arithmetic or paper and pencil strategies would be best. Several representative activities are given, including problem solving, writing word problems, using classroom banks, and ordering from holiday catalogs.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
Available electronically from ENC (ENC-002421)

Playing Green Globs on a TI-81

Mathematics Teaching in the Middle School Vol. 1, no. 5, April-May 1995 (p. 370–374). John E. Owen.

This brief article describes a mathematical game, Green Globs, that can be played on the Texas Instruments *TI-81* graphing calculator. Modifications of the game are included for the *TI-82* and *TI-85* models. The article is intended to clarify for educators the differences between computer and calculator play. Author John Owens describes Green Globs as a staple of first year algebra courses and provides educators with explicit instructions that include illustrations and formulas. The article concludes with a discussion of rationale and objectives.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
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Teaching Graphing Concepts with Graphing Calculators

Mathematics Teacher. Vol. 88, no. 4, April 1995 (p.268–273). Joseph Mercer

This article contains five lessons demonstrating the use of graphing calculators in teaching the slope intercept concept of linear equations, as well as more general principles of two-dimensional graphs. In the first lesson, students examine lines drawn by calculators and experiment with variations in the equation to see how larger co-efficients of *x* affect the steepness of the line. The second lesson introduces the concepts of slope and *y*-intercept. The three subsequent lessons cover the topics of rational coefficients, vertical and horizontal translation, and possible applications of graphs. Author Joe Mercer stresses that graphing calculators change not only the way material is presented, but also the types of questions used in homework, quizzes, and tests.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
Available electronically from ENC (ENC-002415)

Mathematical Models of Simple Harmonic and Damped Motion 2

Mathematics Teacher. Vol. 88, no. 1, January 1995 (p.18–22). Thomas Edwards

This article describes how to model harmonic motion in the mathematics classroom by using a spring and small weights. The goal is to find a mathematical function that will emulate the oscillating spring, beginning with a familiar function that reflects the initial oscillation and then progressing toward one that represents damped oscillation over time. To accomplish this, the teacher asks leading questions and uses a graphing calculator to display the proposed function on the overhead. Students then have the opportunity to discuss limitations of the calculator's display, such as the difference in scaling on the *x* and *y* axes. Finally, the discussion is guided toward exponential functions so that a model of the spring's actual motion is obtained.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
Available electronically from ENC (ENC-002413)

Using Graphical Misrepresentation to Stimulate Student Interest

Mathematics Teacher. Vol. 87, no. 3, March 1994 (p.202–205).
Will Hansen

This article demonstrates periodicity and the discrete nature of the graphing screen by generating two sample misrepresentations of periodic functions with the Texas Instruments *TI-81* graphing calculator. By creating situations that misrepresent the actual event, the teacher has the opportunity to ask students for predictions and then for explanations of what is really taking place. In the article's first example, the visual image seems to indicate that the sine function has a period of 1200 radians. This misrepresentation results from the number of pixel columns and the periodic nature of the sine wave. The other example features images that are very similar to the graphic representations of musical beats. Musical beats occur by creating constructive and destructive interference with two tuning forks of nearly equal pitch. This situation can be simulated on the graphing calculator by using the sine function and applying the number of pixel columns to obtain the solution. The article also provides some suggestions for using the pixel column concept with students.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
Available electronically from ENC (ENC-003699)

Research Gives Calculator a Green Light

Arithmetic Teacher. September 1986 (p.18–21).
Ray Hembree

This article summarizes a 1986 study by Hembree and Dessart that focused on the enhancement of student achievement through school use of calculators. The purpose of the study was to integrate the findings of 79 reports on how calculator use affected the achievement and attitude of students in grades K–12. The article begins with some background information on the calculator debate. Author Ray Hembree points out that much research has focused on whether calculator use harms basic skills, not on how calculators benefit students. The article closes with suggestions for using calculators in the classroom.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
(ENC-007313)

Calculators in the Mathematics Classroom

Arithmetic Teacher. February 1987 (p.61). Developed jointly by the Technology Advisory Committee, the Instructional Issues Advisory Committee, and the Committee to Implement the Recommendations of An Agenda for Action.

This statement was adopted as an official position by the Board of Directors of the National Council of Teachers of Mathematics (NCTM). It contains the NCTM recommendations for integrating the calculator into all levels of school mathematics programs, for use with classwork, homework, and evaluation. It also briefly specifies how calculators should be used and for what purposes.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
(ENC-007311)

Are Calculators a Crutch?

Mathematics Teacher. May 1978 (p.412–413).
Zalman Usiskin

This article discusses the issue of whether or not calculators serve as a crutch for students in mathematics education. It begins by summarizing the position of those who believe calculators do foster dependence: if teachers allow the use of calculators for arithmetic problems that can be done by hand, students will be unable to do such problems on their own. The article goes on to discredit this premise and to defend the use of calculators at all levels of mathematics education. The author writes that a crutch is not always a bad thing but perhaps even a necessity. He argues that it is important to look at the advantages calculators provide instead of the disadvantages that might arise in their absence.

National Council of Teachers of Mathematics (NCTM)
(see p. 16 for address information)
(ENC-007314)

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The first volume (two discs), available now, features the full text and graphics of the NCTM Curriculum and Evaluation Standards for School Mathematics and curriculum frameworks from several states. Other highlights of the first volume include the content of selected Internet sites and ENC publications.

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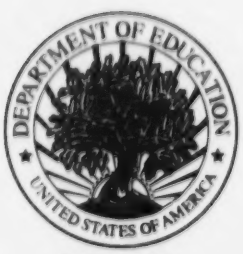

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